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Pipe Trades
Curriculum Guide
12-22-32

Senior High School

CURRICULUM GUIDE

EDUCATION
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DIVISION OF INDUSTRIAL & VOCATIONAL EDUCATION

Vocational Series

# PIPE TRADES 12 - 22 - 32

(Interim Edition, September 1963)

Province of Alberta

Department of Education

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COURSE CREDIT VALUES

Pipe Trades 12 . . . . . 5 credits.

Pipe Trades 22 . . . . . 15 credits.

Pipe Trades 32 . . . . . 15 or 20 credits.

One credit corresponds to a minimum of 40 minutes of instruction time per week.

# INTRODUCTION

The Pipe Trades constitute that specific area of work that is concerned with the conveyance and storage of fluids under automatic or manually controlled conditions, and under natural or artificial conditions of temperature and pressure. The term fluids as used above includes both liquid and gaseous materials.

The term Pipe Trades has a broad connotation in that it includes the following trades in which one can be apprenticed:

1. Plumbing, which is concerned with the supply and distribution of water and the disposal of waste and waste products using efficient and sanitary methods.

2. Steamfitting which concerns the systems of materials and equipment to facilitate the efficient distribution of heat to or within a designated unit of space.

3. Gasfitting which is concerned with the conveyance of liquid or gaseous fuels, connection of appropriate appliances and the efficient operation thereof, including the disposition of all products of combustion. In addition there are two other trades to which people can be apprenticed and are closely related by common components and skills. These are refrigeration and welding whose processes and skills are requisite to various areas of the pipe trades. Instrumentation is still another area of work directly associated with the pipe trades although it is not presently a trade in which one can be apprenticed. Instrumentation is concerned with automatic control of solids, liquids, gases and processes of industry.

The value and importance of these fields to industry and to society cannot be over estimated. The students that select this area of study have a wide range of opportunities ahead of them, particularly when it is understood that each of the trades mentioned have many areas of specialization and include occupations ranging from skilled tradesmen, technicians, sales, engineers on up to executive positions open to those who have the ability and the desire to achieve them.

## OBJECTIVES

The following sequence of courses is designed:

1. To equip a student with sufficient skill and knowledge such that he will be highly employable in the pipe trades.

2. To enable the student entering the apprenticeship programs in the area of the pipe trades, to advance at an accelerated rate on the basis of his proven ability on the job.

3. To assist the student in the development of desirable work habits, a sense of responsibility and the ability to cooperate with his associates.

4. To develop a knowledge and appreciation of the work of allied trades.

5. To assist the student in the development of an attitude of safety regarding all phases of the pipe trades.

6. To acquaint the student with the wide field of the pipe trades and the opportunities that exist for employment and advancement in this expanding industry.

1. Time Allocation

It is recommended that in the Pipe Trades 12, 22, and 32 courses, 50% of the time be given to theory and 50% to shop practice.

2. Safety Program

Every shop must have an effective safety program. In the pipe trades shop, particular attention must be given to incorporating the safety measures used in industry: machines adequately guarded; cleanliness of shop and personnel maintained at a high standard; students properly clothed for their work; etc. Shop organization must be well developed to ensure stressing this important phase of the program.

A good safety program features the following devices: regular, consistent and thorough instruction, constant vigilance and checking by the instructor; safety posters; student safety committee; adequate first aid equipment; instructor trained and up-to-date in first aid methods; dynamic color painting of machines and equipment; adequate working space about machines; safety lines on floor around machines; routine report on accidents however minor; machines and tools in approved working condition; a safety conscious group of students and instructor.

3. Instructor's Records

The instructor should keep accurate records of:

(a) Student enrolment and attendance.
(b) Student work activity.
(c) Theory covered.
(d) Tests given.
(e) Student achievement, aptitudes and attitudes.
(f) Up-to-date inventory of all equipment.

4. Student Records

Instructors should ensure that the student develops and maintains a neat and accurate record of:

(a) Notes on theory.
(b) Daily shop activities (time cards).

5. Enrolment

It is recommended that the maximum enrolment should not exceed 15 students for any laboratory or shop class; however, two classes may be combined for the presentation of theory.

6. Guidance and Vocational Information

Instructors must assume responsibility in their trade area to ensure that students and guidance officials are aware of the local situation. Instructors through the principal have some responsibility for student placement. It is advisable that instructors be active, interested and informed.

NOTE: In order to permit students from an academic Grade X program to cross over into the vocation program at the Grade XI level, schools may combine the 12 and 22 courses into one course for a total of 20 credits. Students would be awarded 5 credits for the 12 course and 15 for the 22 course.

It is also recommended that students taking industrial vocational courses in Grade X, register in the Drafting 12 course as one of the vocational options. In this way much of the drafting required in these courses may be deleted and the time devoted to the acquisition of skill and knowledge.

## INSTRUCTIONS ON THE USE OF THE FOLLOWING GUIDE

The course outline is divided into three columns designated Related Information, Operations, and References. The first column refers to the essential knowledge upon which a well educated tradesman in the pipe trades will depend to adequately carry out the mutual activities outlined in the second column. The second column outlines the type of activity to be performed by the students in the shop. The third column lists the references as sources of information for the items in the other two columns. The references are listed in the back of the curriculum guide. The reference column has not been completed and instructors are requested to insert the reference which they consider to be most suitable for the particular topics outlined. It would be desirable if instructors would also note the time spent on various units. This information will be extremely valuable to the curriculum committee in revising this outline.

The text for Pipe Trades 12 consists of the complete set of INFORMATION SHEETS ON PLUMBING, published by the Federal Department of Labour, Ottawa. It is expected that a similar set of sheets will be available very soon in steamfitting. The latter group along with those on plumbing will be used for Pipe Trades 22 and 32. In addition the following publications should be purchased by the students:

PIPEFITTING BLUEPRINT READING, Fredick J. Drake & Co., available through General Publishing Co. Ltd.

PLUMBING TRADES BLUEPRINT READING AND SKETCHING, Delmar Publication, available through Thomas Nelson and Sons.

## PIPE TRADES 12

The course at the Grade X level is considered to be exploratory in nature. The knowledge and experience gained should enable the student to make an informed decision regarding his possible future in the pipe trades industries.

| Related Information | Operations | References |
|---|---|---|
| Drafting | | |
| 1. Introduction to Drafting<br><br>Drafting tools and equipment - their use and care.<br>Methods of sharpening pencil points.<br>Use of scales. | Proper mounting of paper, border, title block.<br>Method of drawing parallel lines using two triangles.<br>Divide a line or space by parallel line method.<br>Geometrical problems involving arcs and circles. | |
| 2. Lettering<br><br>Vertical Gothic style capital letters. | Three plates 8½ by 11 to include alphabets, numerals, fractions, words and phrases in three sizes - 8½", ¼", 3/8". | Blueprint reading and sketching.<br>Plumbing trades. |
| 3. Orthographic Projection<br><br>Rules of orthographic projection pertaining to arrangement of views, how to balance two and three view drawings, hidden lines, transferring depth measurements.<br>The scaleson architects and engineers scales. | Layout and draw simple two and three view drawings. Some should be drawn to scale other than full size. A minimum of six to eight plates. A scaling practice sheet should be devised to give the students practice in scaling lines of different scales and drawing lines of a given length to a given scale. | |
| 4. Dimensioning<br><br>Size and location of dimensions.<br>How to note scale of drawings.<br>Placement of dimension and extension lines, arrow heads and leaders.<br>Proper placement of dimensional figures.<br>Symbols for feet and inches.<br>Dimensioning of arcs and circles, fillets and rounds.<br>Size and location dimensions holes. | Dimension platesdrawn in Unit 3.<br>Problem sheets prepared by the instructor. | |

| Related Information | Operations | References |
|---|---|---|
| 5. Isometric Piping Drawing<br><br>Importance of being able to draw and interpret isometric piping drawings.<br>Reasons for using isometric rather than conventional plan and elevation views.<br>How to orient views (from what position was this view taken?).<br>Understanding of the basic symbols used to indicate the different types of joints, fittings, valves, etc. as shown in the appendix of Blueprint Reading and Sketching.<br>Material takeoff from isometric piping drawings.<br>How to indicate vertical, horizontal and oblique lines on an isometric. | Practice in making freehand isometric sketches using isometric paper.<br>Practice making freehand isometric sketches without the aid of isometric paper. | |

| Related Information | Operations | References |
|---|---|---|
| 1. Orientation<br><br>Explanation of the program, its goals, objectives and opportunities.<br>Introduction to shop tools and equipment (shop tour). | | Plumbing I<br>Delmar Publications |
| 2. Introduction to Basic Tools<br><br>Safe use and care of tools. | Project using measuring tapes, hack saws, chisels, fibs, reamers, center punches, grinders, hammers, saws, bits and drills. | General Sheets<br>No. 1.2.5<br>No. 1.2.9 |
| 3. Basic Pipe Threading<br><br>Types of pipe, steel pipe, wrought iron, galvanized.<br>Weights and schedules of steel pipe, lap weld, butt weld, seamless.<br>Manufacturing process. | Pipe threads straight and tapered, thread lubricants, cutting lubricants.<br>Basic threaded pipe fittings.<br>Dismantling and care of pipe dies.<br>Threading and assembling pipe units. | General Sheets<br>No. 1.2.2<br>No. 1.2.4<br>No. 1.2.7 |
| 4. Bell and Spigot Pipe<br><br>Types of cast iron pipe.<br>Weights and uses of.<br>Corrosion of cast pipe.<br>Metallurgy.<br>Manufacturing process.<br>Packing materials, lead.<br>Soil pipe fittings.<br>Concrete pipe, non-metallic pipe, uses, fittings.<br>Testing, theory, practical. | Introduction of hand tools used in joining and cutting bell and spigot pipe.<br>Safe operation and care of firepots and blowtorches.<br>Cutting soil pipe.<br>Caulking soil pipe.<br>Project using soil pipe and fittings. | General Sheets<br>No. 1.1.1<br>No. 1.4.11<br>No. 6.1.1<br>No. 1.7.1 |

| Related Information | Operations | References |
|---|---|---|
| 5. Fittings and Tools<br><br>Fittings and tools required to connect threaded pipe to cast iron and non-ferrous bell and spigot pipe. | Project connecting pipe. | |
| 6. Copper Pipe and Fittings<br><br>Types of copper pipe.<br>Grades.<br>Weights.<br>Uses.<br>Manufacturing process.<br>Hand tools for cutting, cleaning and joining.<br>Safe handling and care of torches - acetylene, propane, gasoline and natural gas. (Special emphasis here on safety).<br>Solders - melting points, capillary action, fluxes.<br>Copper fittings. | Soldering and assembling copper pipe units and use of soldering irons in soldering strips of various metals. | General Sheets No. 1.5.10 (soft solder) |
| 7. Hangers and Supports<br><br>Types of pipe hangers.<br>Spacing.<br>Types of inserts, clamps, screwed rods, straps, uses and applications. | Introduction to rod cutting and threading tools.<br>Pipe hanging project. | General Sheets No. 1.2.10 |
| 8. Pipe Grading<br><br>Reasons for grading pipes.<br>Velocity of flow. | Exercises in calculating elevations including percentage grade.<br>Project in pipe grading. | |

| Related Information | Operations | References |
|---|---|---|
| 9. Pipe Bending and Offsets | | |
| Review of fractions and decimals.<br>Mathematics of offsets.<br>Introduction of pipe bending.<br><br>Areas, volumes, cylinders.<br>Conversion of volumes to weight.<br>Density, specific gravity, and water head. | Project on pipe bending, offsets.<br>Projects on threaded offsets. | General Sheets<br>No. 1.2.4 |
| 0. Temperature, Pressure: Measurement and Effects | | |
| Effect of temperature on water volumes.<br>Effect of temperature on closed containers.<br>Effects of temperature on pipe; coefficient of expansion, expansion and contraction.<br>Methods of allowing for expansion. | Experiment in temperature and volume of liquids.<br><br>Experiment on temperature - pressure effect. (relief valves).<br>Experiment in pipe expansion and contraction.<br>Familiarization with swing joints, sissons joint, expansion loop, bends, mechanical joints. | General Sheets<br>No. 1.2.4<br>No. 2.2.1 |
| .. Heat Transfer | | |
| Transfer of heat by : convection, conduction, radiation.<br>Operating principles of a domestic hot water system.<br>Hot water heater and cast iron radiators.<br>Testing, theory and practical. | Experiments on conduction, convection and radiation. | |

| elated Information | Operations | References |
|---|---|---|
| 2. Heating | | |
| Introduction to heating and heating units.<br>Boilers.<br>Heating accessories.<br>Piping systems.<br>Basic physical phenomena<br>-absolute and atmospheric pressure.<br>-boiling point of fluids.<br>Heat transfer equipment.<br>Simple piping systems.<br>Glass pipe hot water heating system display. | Experiments in physical phenomena. | Trane Handbooks<br>HOT WATER HEATING<br>STEAM HEATING HANDBOOK |
| Blueprint Reading | Blueprint Reading | |
| Introduction to valves - globe, gate, check.<br>Piping symbols. | Drafting exercises on piping to various heating accessories.<br>Drafting exercises in laying out one pipe steam system.<br><br>Project - pipe connections to radiator, unit heater, convector and coil.<br>Mock-up glass piping systems. | General Sheets<br>No. 5.1.1 |
| 3. Plumbing | | |
| Introduction to drainage and disposal systems.<br>Fixture familiarization.<br>Introduction to traps - P traps, deep seal, drum, S traps.<br>Venting - explanation of and purpose of venting.<br>Plumbing codes - sizing, drainage, and vent lines. | Experiment on capillary action and syphonage.<br><br>Drafting exercises on simple venting systems.<br>Project - connecting a W.C., lavoratory, bath, and sink. | General Sheets<br>No. 2.3.1<br>No. 2.1.6<br>No. 2.2.1<br>No. 2.2.2<br>No. 2.2.5<br>No. 2.2.4<br>No. 2.2.6 |

| Related Information | Operations | References |
|---|---|---|

14. Opportunities in the Pipe Trades

Plumbing.
Steamfitting.
Gasfitting.
Welding.
Refrigeration.
Sprinkler.
Controls.
The apprenticeship program. Obtain speaker from the apprenticeship board.

| Related Information | Operations | References |
|---|---|---|
| 1. Orientation to Gas Welding and Cutting<br><br>General safety, clothing, eye protection.<br>How oxygen and acetylene are prepared and stored. | Inspection of regulators, cylinders, hoses, torches, welding tips. | |
| 2. The Oxy-acetylene Torch<br><br>Cutting mild steel plate.<br>Manual machine cutting attachments.<br>Setting up apparatus.<br>Parts of the cutting torch.<br>Tip sizing.<br>Theory of metal cutting. | Proper gauge and torch setting.<br>Preheating.<br>Torch angle and gap.<br>Travel speed.<br>Dressing coupons.<br>(Coupons to be saved for weld exercise). | |
| . Safety<br><br>General safety, using a speaker from W.C.B. or from industry. | | |
| . Gas Welding<br><br>Setting up apparatus.<br>Methods of joining metals.<br>- butt weld<br>- lap weld<br>- corner weld (fillet). | Adjusting flame on various tips.<br>Preparing coupons for all three weld types.<br><br>Welding coupons stressing fitup, torch angle, rod angle, preheat, penetration, tacking, burn through, feeding rod, ending weld, proper build up. | |
| Safety<br><br>Use of fire extinguishers.<br>Slag and spatter damage to floor and walls.<br>Safety film. | | |

| Related Information | Operations | References |
|---|---|---|
| 6. Brazing and Braze Welding | | |
| Metallurgy of steel, copper, brass, bronze, aluminum, white metal.<br>Special rods, fluxes, techniques. | Brazing cast iron coupon stressing beveling, fitup, preheat, penetration, floating out slag, use of flux, proper build up, ending weld, post heat.<br><br>Brazing copper or aluminum (using a similar technique) | |
| 7. Silver Solder | | |
| Application.<br>Gauge setting.<br>Melting points of solder.<br>Special fluxes. | Soldering and testing (100psi) an assembly of three welds minimum. ie. tee elbow, etc. | |
| 8. Electric and Arc Welding | | |
| Fusion principles.<br>A. C. Welders.<br>D. C. Welders.<br>General safety, clothing, face protection.<br>Coated rods, type, size, care, in handling.<br>Precautionary measures when in the welding area. | Inspection of machines, cables, lugs, electrodes, electrode holders, helmets, clothing. | |
| | Flat position beads on mild steel plate.<br>Machine settings.<br>Striking arc, maintaining arc, proper arc length.<br>Unfreezing rod. | |
| | Butt welds, material, preparation, spacing, type of electrode, machine setting, rod angle and feed, arc length, forward rate, penetration, slag removal, spatter control. | |
| | Fillet welds (horizontal and vertical).<br>Rod angle and speed.<br>Machine settings.<br>Root penetration.<br>Multi pass welding. | |

| Related Information | Operations | References |
|---|---|---|
| 9. Weld Defects | | |
| Causes and remedies.<br>Types of defects, slag inclusion, undercutting, lack of penetration.<br>Methods of detection - pressure tests, X-ray, magniflux, gama ray. | Cutting and grinding the students' butt weld to expose defects. | |
| 10. Blueprint Reading | | |
| Welding symbols, specifications. | | |
| First Year Review of Steam Heating | | |
| 11. Heating (Steam) | Experiment in accuracy of pressure temperature devices. (Stress to be on the accuracy of instruments for various ranges of readings.) | |
| Uses of steam for power and heat.<br>Sensible heat.<br>Total heat.<br>Latent heat.<br>Pressure temperature effect.<br>Glossary of technical terms.<br>Manometers, spring gauges.<br>Bordon tubes. | | |
| 12. Steam Generating Units | | |
| Care in receiving, handling and erection of boilers.<br>Sectional boilers.<br>Package units.<br>Fire tube and water tube.<br>Boiler connections, headers, equalizers.<br>Water supply.<br>Blowdowns and drains.<br>Boiler trim.<br>Boiler controls, safety, temperature, pressure, level.<br>Pressure and temperature relief.<br>Water treatment.<br>Fuels.<br>Horsepower and rated capacity. | Erecting a cast iron boiler.<br>Installing trim.<br>Testing. | |

| elated Information | Operations | References |
|---|---|---|
| 3. Plan Reading | | |
| Sectional views of boilers.<br>Manufacturer's specifications.<br>Rated capacaties. | | |
| . Steam Heating Systems | | |
| Piping connections for twinning boilers.<br>One pipe system, mains grading up, mains grading down.<br>Air vents, how to deal with air.<br>Venting points.<br>Effect of air on heat transfer. | | |
| Plan Reading | | |
| Heating symbols.<br>Introduc ion to simple heating systems. | Material takeoff from simple one-two pipe systems. | |
| Steam Heating Systems | | |
| Two pipe system.<br>Dry, gravity, wet, return. | Installing two pipe system on boiler. | |
| Heating Equipment | | |
| Operating principles of convectors, radiators, coils, exchangers. | Visual inspection of equipment, visit to school equipment room or industrial plant. | |
| Plan Reading | | |
| A.S.H.R.A.E. ratings and manufacturers terminology for heating units. | | |
| Principles of the Centrifugal Pump | | |

| ated Information | Operations | References |
|---|---|---|
| Plan Reading | | |
| Sectional views, symbols, manufactures specifications. | | |
| Buoyancy, density, pressure head, vacuum, friction loss, sizing, temperature effect, as related to pumps. | Installing condensate receiver in boiler return line, boiler connections including low water cutoff. Investigating pump capacity against various head conditions. | |
| Steam Traps | | |
| Ball float, thermostatic, float and thermostatic, thermodynamic, lift, direct return, high and low pressure traps, their principles, uses, and installation locations. | Installing traps on steam mockup. Determining condensate rate of various types of traps. | |
| Expansion Allowance | | |
| Pipe supports, hangers, anchors. Swing joints, scissor joints, expansion joints, coefficient of expansion, use of expansion joints. | | |
| Insulation | | |
| Types in general use. Visual inspection, demonstration of application, use of insulating saddles. Use a representative from industry for this unit. | | |
| Maintenance of a Heating System | | |
| Preventative maintenance - the accounting of. Repair and adjusting valves. Cleaning and servicing boilers. Cleaning and adjusting controls. Testing fuel quality. Testing combustion products. | Testing combustion products. Repairing leaks, packing valves. Repair of heating accessories. | |

| lated Information | Operations | References |
|---|---|---|
| Maintenance of Heating System Contd. | | |
| Servicing accessories.<br>Trouble shooting of equipment, supply and return mains and rizers.<br>Shutting down and starting up a heating system. | | |
| Heating (Hot Water) | | |
| Introduction to hot water heating systems.<br>Advantages and disadvantages of hot water systems for residential, commercial, and industrial installations. | | |
| Plan Reading | | |
| Principles of hot water heating systems embracing gravity, forced, direct and reverse flow.<br>Two pipe direct return.<br>Two pipe reverse return.<br>Monoflow continuous circuit. | Isometric sketches and material takeoff from plans. | |
| Components of a Hot Water Heating System | | |
| Expansion tanks, air cushion tanks.<br>Relief valves, pressure gauges.<br>Flow control valves.<br>Combination water feed and relief.<br>Balancing, radiator valves.<br>Air relief and boiler vent fittings.<br>Altitude and temperature gauges.<br>Aquastats.<br>Air changing valves.<br>Pumps.<br>Heating unit connections. | Installing trim on hot water boiler.<br>Installing one pipe forced system.<br>Installing two pipe forced system. | |

| lated Information | Operations | References |
|---|---|---|
| . Flow Control and Balancing of H.W. System | | |
| Effect of friction and head on temperature drop.<br>Gallonage.<br>Circulator capacity curves.<br>Pipe sizing tables.<br>Equalizing friction loss. | Friction effect through various types and sizes of pipe.<br>Head vs capacity of pumps and comparison to manufactures curves. | |
| . High Pressure Systems | | |
| High pressure connections.<br>Pressure reducing stations, size, selection, location.<br>Selection of bucket traps.<br>Use of flash tanks.<br>Maintenance of P.R.V.'s. | Installing and testing a pressure reducing station. | |
| Plumbing | | |
| Review of first year skills.<br>Caulking, flashings, water, air, traps, seals, syphonage, gravity flow, pressure and corrosion. | | |
| Introduction to Plumbing Code | | |
| Administration.<br>Responsibility and authority.<br>Inspection.<br>Penalties. | Inspection of backwater valves, roof hoppers, wall hung closets, drinking fountains, and other misc. fixtures. (This could be a guided tour to a plumbing warehouse.) | Alta. plumbing code, p. 10-26 |
| Plan Reading | | |
| Single line drawings of basement and one story sanitary drainage, storm drainage. | | |
| Principles of Drainage | | |
| Grading lines, allowable material, allowable sizes, reverse flow. | | Alta. plumbing code |

| ated Information | Operations | References |
|---|---|---|
| Venting | | |
| Explaination of fixture unit.<br>Fixture unit tables.<br>Stack vents.<br>Back vent.<br>Yolk vent.<br>Weights of lead roof flashings. | Forming a lead roof flashing. | |
| Plan Reading | | |
| Coordination of architectural and mechanical drawings.<br>Dimensional and material takeoff from single story light frame construction.<br>Explaination of terminology, symbols, and sheet layout systems. | | |
| Water Supply | | |
| Water supply sources.<br>Regulations affecting installation, units, and unit sizing tables.<br>Distribution systems.<br>Valves and faucets. | | |
| Plan Reading | | |
| Hot and cold water distribution including hydro pneumatic systems, gravity and forced recirculation systems. | Rough in for drainage, venting and water lines for single story domestic system including water closet, lavatory, kitchen sink, hot water tank, laundry tray, bath and floor drain. | |

| lated Information | Operations | References |
|---|---|---|
| . Plumbing Fixtures | | |
| Uncrating.<br>Detecting flaws.<br>Manufacturers specifications.<br>Job specifications.<br>Rough in measurements.<br>Setting the fixture.<br>Supplies.<br>Selection and inspection of water closets, urinals, lavatories, baths and showers, drinking fountains and wash fountains. | Building a lead safe for a shower stall. (lead box)<br><br>Lead burning project. | |
| Rural Sewage Disposal | | |
| Disposal methods.<br>Regulations affecting installations.<br>A complete study of the Rural Sewage Disposal code and approved plans for disposal units. | Tour of local sewage disposal system. | Alta. Plumbing code. |
| Plan Reading | | |
| Complete material take off from multi-story building including plumbing and heating materials and equipment. | | |

| Related Information | Operations | References |
|---|---|---|
| 1. Plumbing | | |
| Review of second year; drainage principles, types of venting, plumbing codes and regulations. Trade nomenclature. | Review of skills necessary to perform the following operations; operating pipe machines, operating power dies, cutting soil pipe. Safety procedures required for operation of all shop power equipment. | |
| 2. Plan Reading | | |
| Review of multi-story architectural - mechanical plans. Nomenclature, symbols, specifications related to above. Material take off from plans. | | |
| . A Detailed Study of Plumbing | | |
| Codes and regulations. Use of pipe sizing tables. Rough-in dimensions for w.c., lavs., urinals, service sinks, drinking fountains, washers, etc. | Ordering material and roughing in for a multi-fixture washroom composed of 4 W.C., 2 urinals, 4 lavs., 1 service sink, 1 drinking fountain, 1 auto-washer. Water testing completed unit. | |
| . Plan Reading | | |
| Layout sketches using plans and code-books. Wet vent. Loop vent. Circuit vent. Relief vent. | | |
| Mathematics | | |
| Review of weaknesses exposed in work to this point. | | |

| Related Information | Operations | References |
|---|---|---|
| 6. Service Work | | |
| Drain cleaning equipment, rods, augers, snakes, locating trouble sources. Maintenance of installations. Care of equipment. The use of Kaffer fittings. | Use of equipment in removing obstructions placed in previous project. | |
| 7. Flushometers | | |
| Theory of operation. Sizes, types, pressures. Manufactures specification. | Dismantling and reassembling a flushometer. | |
| 8. Water Closets | | |
| Ballcocks, float valves, flushvalves. Pressure, repair and adjustment of mechanisms. | Dismantling and reassembling of a water closet. | |
| '. Faucets, Valves | | |
| Types, uses, codes. Special tools required for repair. | Reseating and repacking valves and faucets. | |
| . Water Supply | | |
| Municipal and private supply systems. The problems of maintaining adequate fresh water supply. Shallow and deep well pumps, submersible and jet. Recommended installation and piping hookup for various types of pumps. | Installing piping on shallow well pump. | |
| Water Meters | | |
| Government regulations and recommended installations. | Installing piping on a standard water meter. | |

| Related Information | Operations | References |
|---|---|---|
| 12. Plan Reading | | |
| Detailed study of regulations and codes for domestic water distribution. | | |
| 13. Water Softeners | | |
| Chemistry of water softeners.<br>Economy involved in softening water.<br>Types of water softening systems. | Chemical tests of waters before and after treatment. | |
| 14. Domestic Hot Water Heaters | | |
| Operating principle.<br>Types, sidearm, center flue, water back.<br>Harnesses for commercial installations.<br>Dual temperature installations. | Installing dual temperature dual unit harness on hot water tanks. | |
| 15. Domestic Hot Water Systems | | |
| One pipe systems.<br>Two pipe natural circulation system.<br>Continuous circuit forced system. | Adding one pipe system to preceding project.<br>Adding natural circulation and forced system to preceding project. | |
| Review | | |
| 16. All plumbing to this point. Enrichment: covering dry mop vacuum systems, $CO_2$ systems, or new methods and fields of plumbing. | | |
| Steam 3rd. Year | | |
| 17. Plan Reading | | |
| Review of symbols.<br>A detailed study of a boiler room plan.<br>Specifications of boiler trim, receivers, headers and safety devices. | Sketching isometric layout of the school heating plant and checking against the actual installation. | |

| Related Information | Operations | References |
|---|---|---|

18. Review of Second Year Heating

The Boiler Code
Its effect on the steam-fitters' work.

19. An Understanding of the Principles of Heat Loss

Heat transmission tables.
Coefficient of transmission. (U)
Sizing of supply and return mains.

20. Traps

Detailed study of location, theory of operation, selection, testing, maintenance of steam traps.

Testing traps under various atmospheric and pressure conditions.

21. Plan Reading

Determining trap locations for steam mains, unit heaters, converters.

22. Heating Systems

The advantages and disadvantages of panel or radiant heating, hot water heating, steam heating, electrical and hot air heating.
A brief venture into air conditioning.

23. Low Pressure Steam Systems

Methods of equipment take offs. Looping, upfeed and downfeed connections.
A study of pressure drop.
Properties of steam.
Selection and location of heating units.
Mathematics related to low pressure systems.

24. Plan Reading

An understanding of nomenclature used to designate heating equipment.

| Related Information | Operations | References |
|---|---|---|

25. Condensate

Converters and low condensate return systems.
Converting hot water to equivalent steam radiation.
Water heating below boiler water line.
Condensate pumps.
Calculation of condensate lift and the inherent problems created.
Remote condensate pumps.
Lifting with traps.

26. Designing a Domestic Heating System

NOTE: The instrumentation should be concurrent with this.

Calculation of heat loss.
Selection of boiler and heating units.
Piping system layout.
Determining pressure drop, pipe size.
Selecting specialties.
Sizing and selecting return equipment.
Related plan reading.
Related mathematics.

Construction of system as designed.

27. Piping Failures

Corrosion.
Erosion.
Oxidation.
Electrolytic.
Methods of reducing or preventing excessive failures.

28. Instrumentation

Methods of control, temperature, pressure, flow, climatic.
Control through zoning.
Control by pipe or element sizing.
Automatic and manual control valves.

| Related Information | Operations | References |
|---|---|---|
| 29. Control Valves | | |
| Manual control - gate, globe, needle valves.<br>Pressure reducing valves.<br>Pressure control valves.<br>Level control valves.<br>Flow control valves.<br>Multi-port valves.<br>Three way valves. | Dismantling, maintenance of control valves.<br>Installing control valves in a miniature control system. | |
| 30. Boiler Controls | | |
| Fuel, flue, climatic controls.<br>Aquastats, pressure - controls, low-water-cutoffs.<br>Auto-water feeds.<br>Programming controls.<br>Safety controls and relief valves. | Installing control system on low pressure steam system. | |
| | Design and install an instrument control panel.<br>The following controls and meters are recommended:<br>Venturi meter.<br>Flow and pressure control meters.<br>Control valve.<br>Level control meter.<br>Inter-connected multi-port valve with a pneumatic system of positive manual and automatic shutoff.<br>Testing and operation of the above system. | |
| . Gasfitting<br>L.P.and Natural Gases | | |
| Chemical properties of gases.<br>Variation in B.T.U. content.<br>Safety procedures during handling. | | |
| . Combustion | | |
| Products of combustion.<br>Gas-air mixtures.<br>Natural and L.P.gas flames. | Testing products of combustion under various flame conditions.<br>Carbon, $CO_2$, tests. | |

| Related Information | Operations | References |
|---|---|---|

33. Burners

Development of the bunsen type burner.
Burner orfices.
Factors affecting burner design.
Space limitation, locations.
Selection of burners.
Burner types, upshot, inshot, criss slot, long slot, ring, drilled port, ribbon burners.
Venturi multiple slotted ports.
Raised ports.
Individual jet.

Setting up and adjusting burners.

Sizing air intakes and flues.

4. Venting Gas Appliances

Protection of combustible material.
Approved venting materials.

Assembling vent pipes.

5. The Gas Approval Board

Its purpose.
Rating and testing of material quality.
Approval of appliances.
Altitude effect on gas appliances.

. The Alberta Gas Code

Permits, licensing and inspection.

. Responsibility

Journeymen, masters, inspectors.
Moral and ethical responsibility.
Extensions, alterations and conversions.
Types of appliances.
Piping regulations, pipe sizes, appliance unit rating.

| Related Information | Operations | References |
|---|---|---|

38. Installation of Gas Lines

| | |
|---|---|
| Gas capacity tables.<br>General regulations for installation.<br>Testing regulations. | Design and install piping for a gas system connecting hot water heater, kitchen range, unit heater, refrigerator, boiler.<br>Testing and operating system. |

39. Plan Reading (related)

40. Controls

| | |
|---|---|
| Operating principles of thermostats, thermocouples, control valve and auxiliary equipment nomenclature.<br>Operation and regulations affecting relief valves, regulators, pilot safety devices, manual and automatic gas controls.<br>Domestic water heater controls.<br>Residential heating controls. | Assembly, adjustment, testing of: burners, burner valves, regulators, pilot valves, thermocouples, power piles, flame rods. |

41. Plan Reading as related to controls

42. Industrial Pipefitting

43. Plan Reading

Symbols, flow charts, vessel drawings.
A detailed study of spool sheets.

4. High and Low Pressure Systems, Chemical Systems

Materials, nomenclature of pressure systems.
Chemical lines, stainless, aluminum, lead, glass, plastic.
Chemical and high pressure valves, diaphram, pin, ball, and double seat.

| Related Information | Operations | References |
|---|---|---|

45. Industrial Control Systems

A study of the advantages, uses, and applications of:
electrical
electronic
pneumatic
hydraulic control systems.

Instrument repair and maintenance.

46. Rigging

Materials, safety, nomenclature of ropes, tackle, hitches, scaffold, hoisting equipment.
Visiting speaker from the compensation board.

Project using rigging equipment.

7. Field Trip to Industrial Plant

Preparation of students re:
The industrial process they will see; economics of the industry.
Safety procedures to be observed.
Function of the operating personnel.
Job opportunities.
Recap of trip.

3. Testing and Review

Date Due

## REFERENCE BOOKS

"Plumbing I - Related Information", Delmar Publication, available through Thomas Nelson and Sons.

Trane Handbooks, "Hot Water Heating", Trane Ltd. (publishers and distributors).
"Steam Heating"

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Handbook of Plumbing Sketches 1961, Associate Committee on National Building Code, National Research Council, Ottawa, Canada.

Metalbestos Company, pamphlet on gas venting, (available through Western Supplies).

Alberta Gas Approval Board, quarterly bulletin.

C.S.A., Gas Code.

Minneapolis, Honeywell, Control Handbook.

General Controls, handbook.

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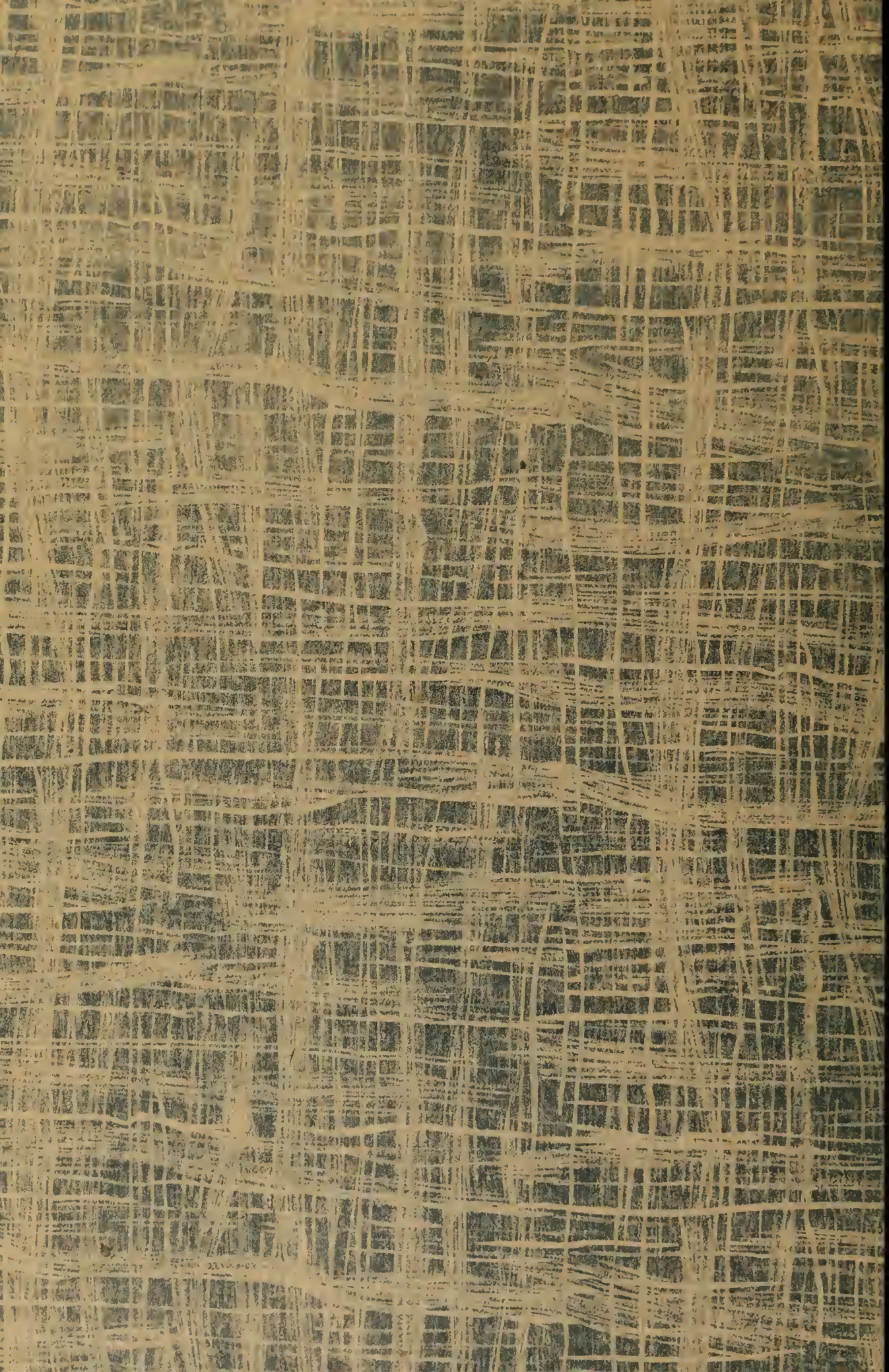
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